The Way Ahead in Game-Based Learning

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Overview

- **Background**

- **A Case for Game-Based Learning**

  - Science of Learning

- **Developing Game-Based Learning**

- **Challenges & Issues**

- **Example**

- **The Way Ahead**

Background

- **Popularity of Video Games**

  - > $10 Billion Industry yearly
  - Top game budgets exceed $50 Million

    - GTA IV is estimated at $100 Million

  - Maple Story has > <u>50 Million</u> registered players!

  - Second Life has > 3 million residents

- Demographics

  - "Digital Natives"

Background

BUT, serious games are:

- Mostly Hype…NOT science
- Lack of guidelines

World of Warcraft Blizzard Games	*Civilization 4* 2K Games	*Second Life* Linden Labs	*SimCity 4* EA Maxis

Opportunity to exploit technology is tremendous!

Background

- Definitions:
  - Game
  - Serious game
- Simulation *vs* Virtual World *vs* Game

Elemental
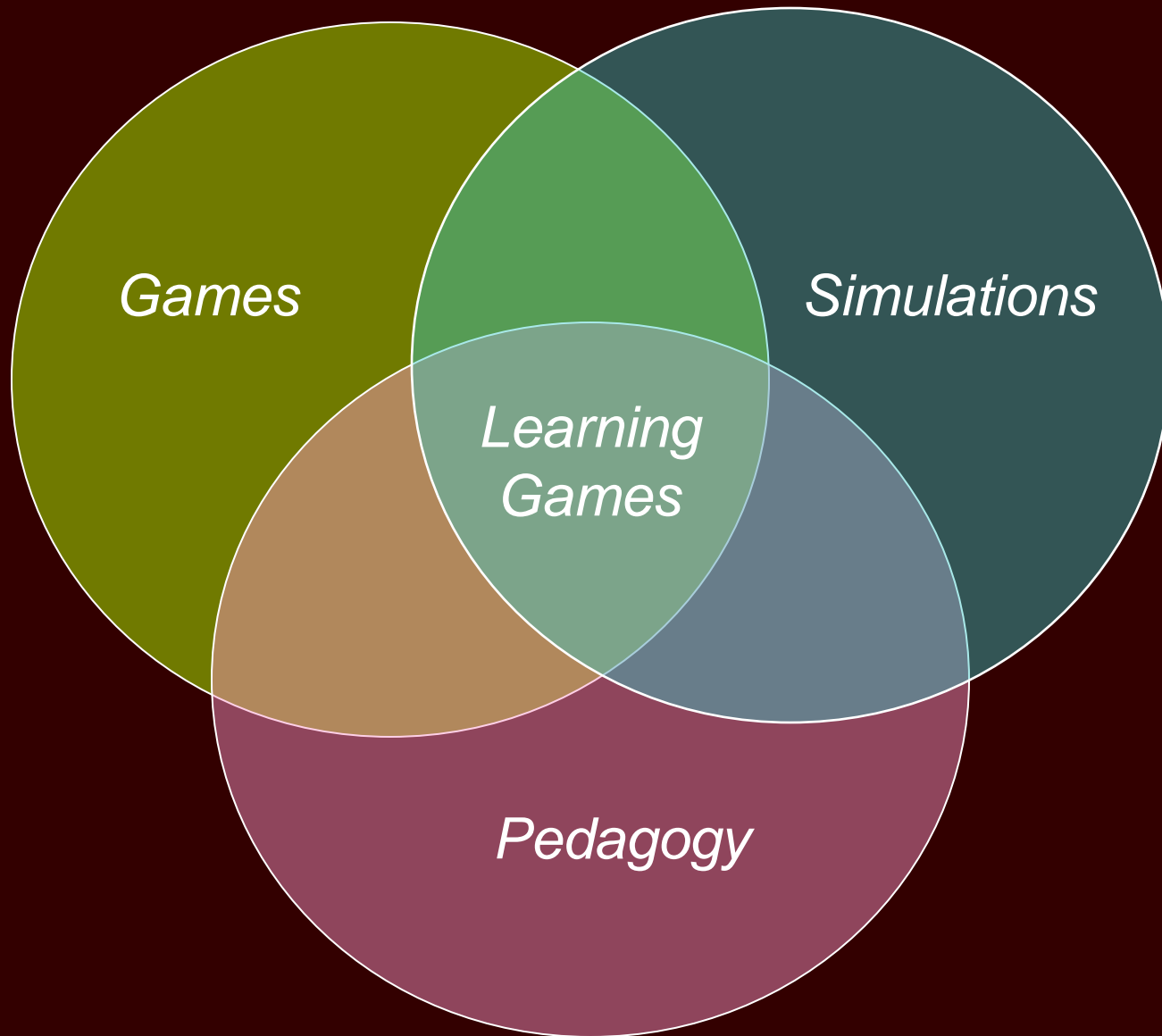Hidden Agenda Games

The Binary Game
Cisco

Darfur is Dying
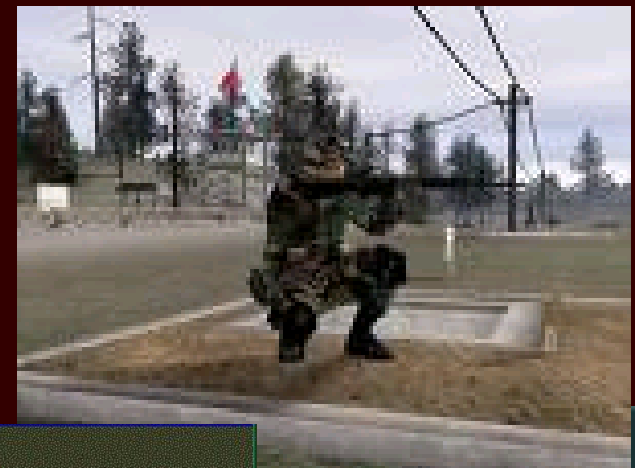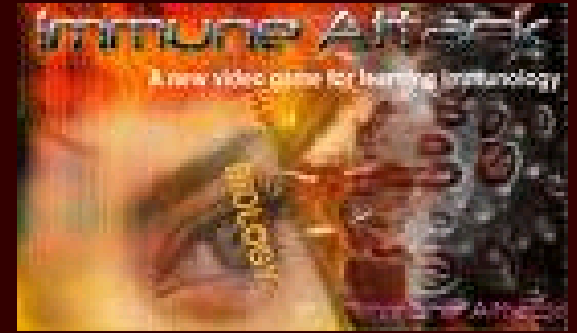MTV-U

Fatworld
Persuasive Games

Background

A Case for Game-Based Learning
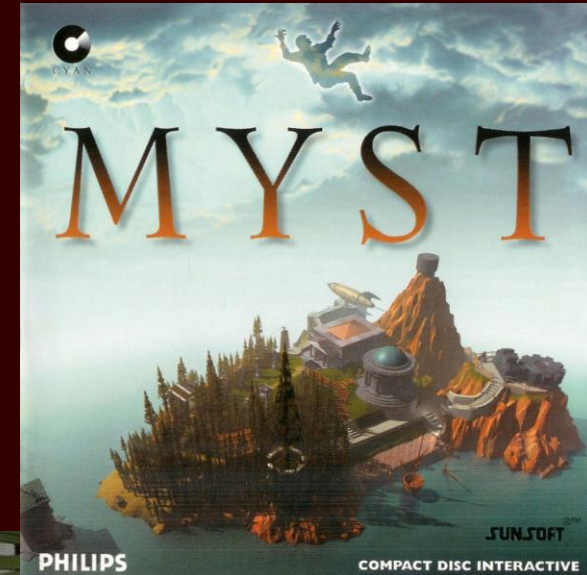
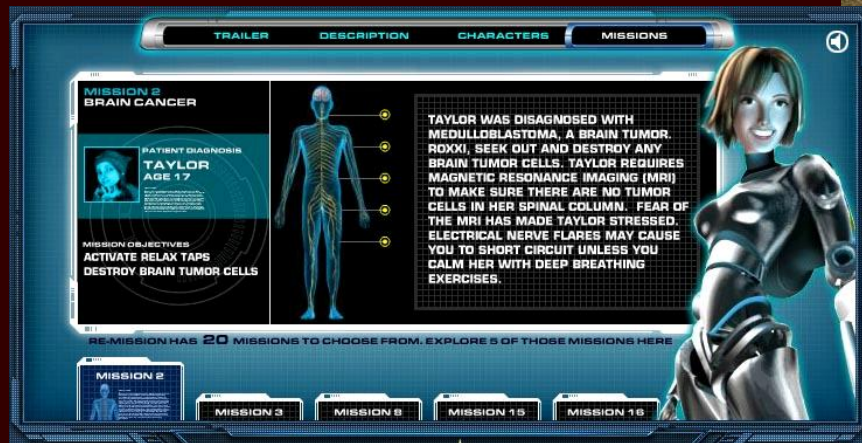*From the Science of Learning:*

- Anchored Instruction/experiential learning

    - Situated learning

- Meaningfulness of material

- Authenticity/Fidelity

A Case for Game-Based Learning

From the Science of Learning:

- Compelling narrative

- Story

A Case for Game-Based Learning

From the Science of Learning:

- Active Participation

- Learner Control

A Case for Game-Based Learning
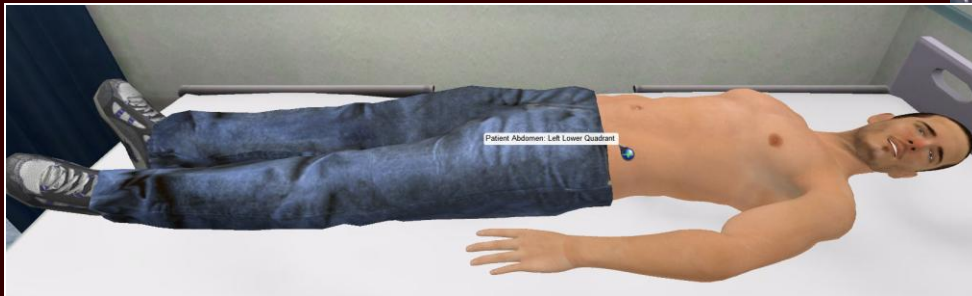
From the Science of Learning:

- Model-based Reasoning

- Metacognition

- Self-Regulation

A Case for Game-Based Learning

From the Science of Learning:

- Self-efficacy

- Goal Setting

- Intrinsic Motivation

A Case for Game-Based Learning

From the Science of Learning:

- Continuous Assessment

- Frequent Feedback

- Reward

A Case for Game-Based Learning
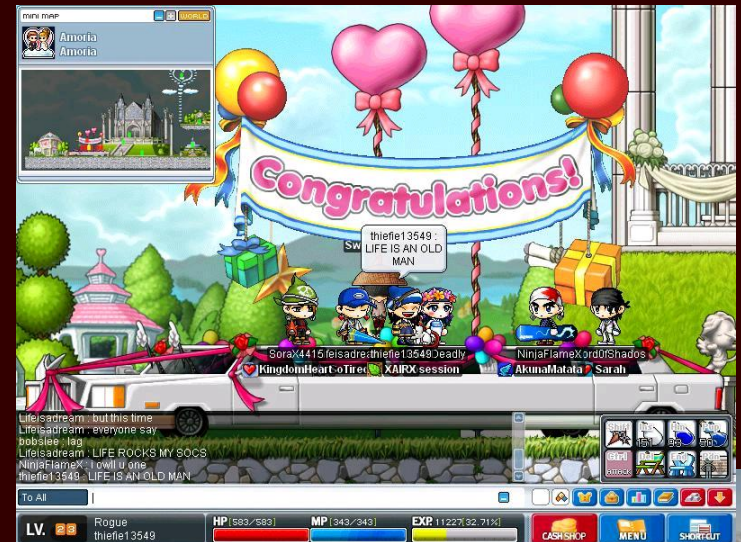
From the Science of Learning:

- Immersion/Engagement

- Emotional Context

- Embodiment

- Personalization

A Case for Game-Based Learning

From the Science of Learning:

- Collaborative Learning

- Social Status

- Vicarious Learning

- Coaching/Mentoring

Why games *should* teach…

- Players learn **in context** by interacting with objects in a complex world.

- Consistent with **anchored, experiential learning,** learners can make connections among concepts
  - Players build sound **mental models** of a domain.

- Games are excellent **model-based** environments to foster complex reasoning.
  - Students observe system behavior over time; draw and test hypotheses.

- Games provide the players with **constant challenge**--many parallel achievements feed into an overriding goal.

- **Goals** are concrete and immediate.
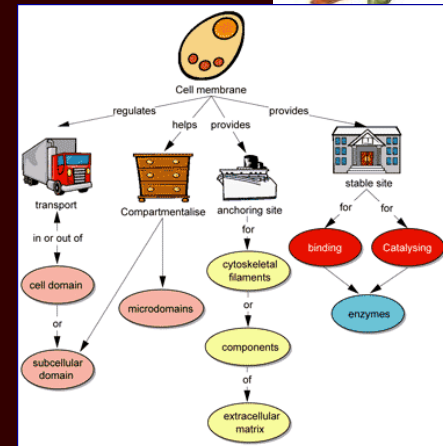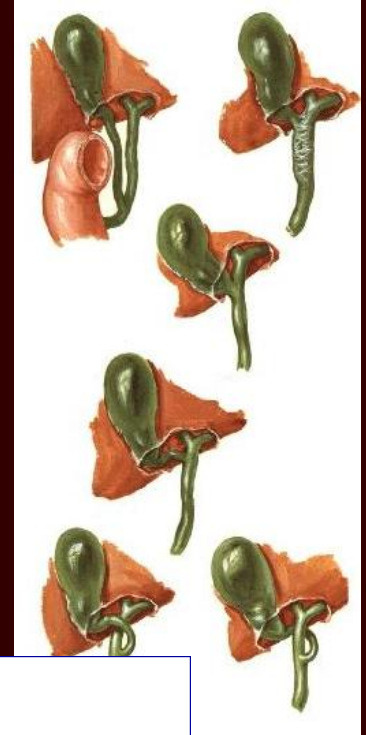
Why games *should* teach…

- Players negotiate successive, proximal goals—result is a feeling of **constant accomplishment.**
    - Likely to have a positive effect on **self-efficacy**.

- Games provide a **continuous source of assessment and feedback** so that players know where they stand with respect to their goal accomplishment.

- Game play is **self-regulating**.

- Players are **intrinsically motivated** to accomplish the next challenge and will readily acquire new knowledge as required to do it.
    - Moreover, mechanisms to track and plan **successive achievement** are often used (e.g., skill trees).

16
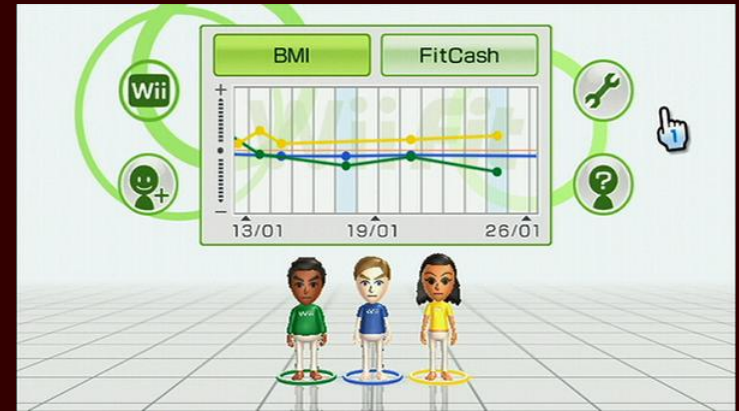
Why games *should* teach…

- Gaming is fundamentally a **social phenomenon**
  - It often results in distributed social groups that foster **collaborative learning** and resemble communities of practice.

- The **embodiment of the student** in the story enhances the players' sense of connection to the game
  - This enhances engagement.
  - **Personalization** of a player's avatar may do so as well.

- A player's accomplishments can easily be made public in a game format.
  - Such **public rewards** and recognition provide a **sense of competence, challenge and motivation** to achieve more.
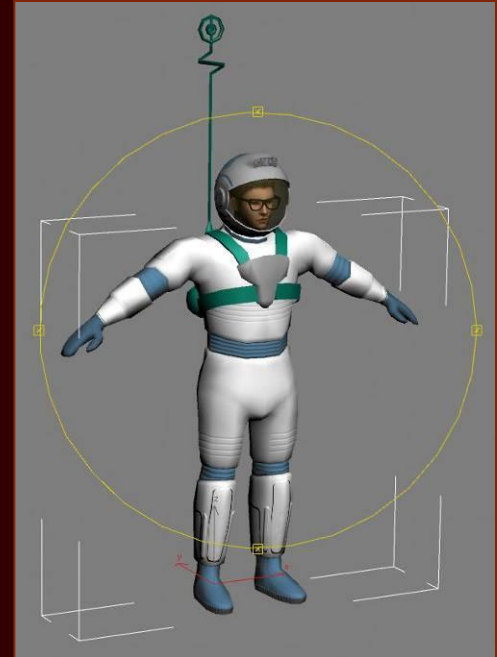
Driving Question
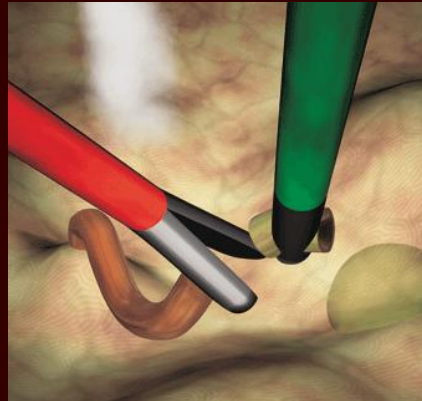
So, how should we build games that teach?
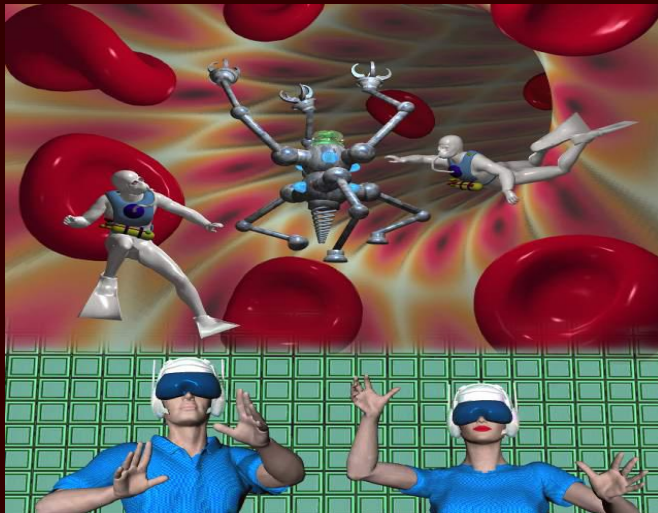
Incorporating the Science of Learning

- Include Domain/Subject Matter Experts on the team
- Include Learning experts on the team
- Make a deliberate attempt to incorporate sound learning principles:
  - Provide compelling narrative to enhance motivation
  - Provide compelling visuals to increase immersion
  - Embed learning into a meaningful context
  - Provide continuous feedback
  - Make goal accomplishment salient to foster metacognition, self regulation
  - Include public recognition and reward to enhance motivation
  - Incorporate collaborative learning

Exploit game features so that they teach!!

Challenges & Issues

- User Acceptance

- "Coolness"

- Cost

- Ease of Modification & Reuse

Challenges & Issues

User Acceptance:

- Sometimes using the term "game" is off-putting
- Collect empirical evidence of effectiveness
- Attempt to estimate ROI
- Work closely with targeted users
- Iterate based on user feedback
- Create adjuncts to traditional methods

Challenges & Issues

Ensuring "Coolness":

- Hire designers/developers who understand what makes games compelling
  - Hire "cool" people
- Involve users in all phases of design

IS IT FUN!?

Challenges & Issues

Containing Costs:

- Use low cost game engines
- Employ students for programming & graphics
  - Internships
- Consider "modding" an existing game
- Re-use content
  - Best done at asset level

Challenges & Issues

Enhancing Ease of Modification:

- Develop scenario generation tools
- Use game engines that allow easy mods
- Develop/adhere to standards (SCORM-like)
- Embed content into "mini games"
  - Lunar Quest Example

Example: Lunar Quest

- Funded by NSF

- Targeted at college-freshmen level Physics

- Adjunct to classroom

- Alternate Timeline: Retro 50s

Addressing the Challenges

Modification:

Peter Smith (Producer) and Tim Holt (Designer) Present Lunar Quest at The Austin Game Developers Conference

- Hybrid Approach
  - 3-D Massively Multiplayer On-line Game
  - 2D Flash-based Mini Games

- Learning content in "light weight" mini games
  - Cheap to create
  - Easy to modify
  - Enhances reuse of assets, scalability

- Modular Content
  - Scalable to multiple domains (e.g., chemistry, geology, social sciences) inside the same virtual world

Addressing the Challenges

Cost:

- Selection of Multiverse Engine (www.multiverse.net)
  - Profit share model (e.g., we don't pay)
- Hybrid MMO/minigame approach
  - Learning content embedded in light weight minigames
  - Minimizes degree of advanced coding in favor of Flash-based content
  - Can be done (well) by undergrads
- Use of off-the-shelf and student-created art assets

The Way Ahead

Research Issues:

- Enhanced assessment routines
  - Automated tracking
  - Dynamic assessment of performance
- Intelligent Tutoring
  - Draw inferences about mastery
  - Automatic feedback/remediation
- Establish a Science of Game-Based Learning
  - Which features are most important?
  - What provides the biggest bang for the buck?

The Way Ahead

- Game-based technologies hold great promise as teaching tools

- More empirical research is needed

- Mechanisms to share results are needed

- Better business models are sorely needed
  - Need to make compelling business case
  - May help encourage funding

- Ultimately, scientific studies must be translated into useful design guidance

Let the (Serious) Games Begin…